Data Warehousing in Regional Health Information Organizations

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A Regional Health Information Organization (RHIO) is an emerging technology that allows healthcare providers the ability to access patients’ health information through the use of centralized or decentralized data warehouses. In order for a RHIO to be most effective, multiple providers in a geographical area must participate. Several different types of RHIO models are most prevalent in the emerging market. In order to be most successful, the future of RHIOs will need to include all facets of the data exchange and not limited to clinical data.

A RHIO system houses patient data that can be shared with any entity that is qualified to receive the information for healthcare purposes. This is typically limited to healthcare providers (hospitals, doctor’s office, pharmacies, etc.) In a RHIO environment, any healthcare professional can obtain detailed information about a patient instantly. This will provide immediate feedback on a patient’s condition, plan of care, and current medications.

RHIOs are effective when they contain healthcare information from multiple sources. The challenge in creating a RHIO is how to warehouse the vast data obtained from multiple healthcare providers. Gathering information into one information system is called data integration. Data integration is “forming valid relationships between data sources”. (Arzt, 2005). There are five basic model types for data integration.

The first model type is the Smart Card model. In this model, a centralized database does not exist however; the data is stored on a smart card that the patient must transport to each healthcare provider that the patient visits. Data is both read and added to the
smart card by using a smart card reader/writer. Because of the lack of a centralized
database, broad analysis of healthcare records would be difficult to perform.

The biggest advantages to using the Smart Card model are the utilization costs and the
process of adding patients to the model. Because a centralized database is not used in
this model, the cost of using the Smart Card model, once it is implemented, is relatively
low. Additionally, patients can be added to this model at a staggered pace and do not all
have to be added to the system at once. Therefore, the transition to adding patients to this
system could be smooth.

A disadvantage to this model is that the patient must be present and the patient must
provide their smart card to the healthcare provider in order for the healthcare record to be
updated. An additional disadvantage is the cost involved in developing interfaces into
current medical record programs, which are needed to implement the smart card system.

The second model type for data integration is the Peer-to-Peer model. In the basic
Peer-to-Peer model each individual healthcare provider’s information system
communicates with other healthcare provider information systems. In the basic Peer-to-
Peer model, there is not a centralized database. The user must know the specific location
to send a healthcare information request or query. There are some variations to this
model. One variation is the Broadcast Peer-to-Peer model. This model allows the user to
send a query using a network broadcast to multiple systems. All the systems must use the
same program language. A second variation of the Peer-to-Peer model is a Facilitated
Peer-to-Peer model. This variation of the basic Peer-to-Peer model does incorporate the
use of a centralized database.
An advantage of the Peer-to-Peer model is that it works well for RHIOs that contain fewer participating healthcare providers. This model has a low implementation cost because there is generally not a centralized database. Similar to the Smart Card model, the Peer-to-Peer model can be implemented in stages. Additionally, the absence of a centralized database eliminates the need for massive coordination by the RHIO participants.

The biggest disadvantage of the Peer-to-Peer model is that data transactions are not real time. Furthermore, the user requesting healthcare information must know specifically where to send the data request. Every healthcare provider would have to know exactly where each patient received medical services, which may lead to an incomplete medical record.

The third model type for data integration is the Information Broker also known as the Federated model. This model is based on a centralized data warehouse, which only contains a patient master list but does not contain any healthcare information. The centralized database advises the user of each healthcare provider the patient has accessed. The user must then query each individual healthcare provider to obtain the healthcare information.

There is a security advantage to using this system. In this model, the healthcare provider’s system that houses the health information can refuse to respond to a request that does not meet appropriate security standards. Because this system utilizes a centralized data hub, it also allows for data analysis of patient populations. Implementation of this model type may also be easier because the model requires a
registration with the centralized hub and does not require the transfer of healthcare information through the hub.

A disadvantage to the Information Broker model is that there is not an alternative to transfer or obtain data if the central database has an operational failure. Another disadvantage of this model type is the presentation of the data may not be clear because the actual data is not housed in a central location therefore, the output may be different for each system.

The fourth model type for data integration is the Partitioned Warehouse model. In this model, a centralized database is used and operated by the RHIO. This model differs from the information broker model because the partitioned warehouse model not only houses a centralized list of patients; it also houses the actual patient health information. The health information is housed in data vaults or servers. The information is segregated by each healthcare provider that sends data to the RHIO. In this model, the response to each query is provided by the RHIO. Healthcare providers are required to update the RHIO on a regular basis.

The main advantage of the Partitioned Warehouse model is the ability to retrieve healthcare information with one query within one system. A secondary advantage to this model is it can support both real time and batch communication, which leads to a more efficient gathering of healthcare information.

A significant disadvantage to the Partitioned Warehouse model is the need for all providers to constantly maintain and update the data on the server. Another disadvantage is the sole reliance on one system to house and obtain all patient data. In the event that
the RHIO is either permanently or temporarily unavailable, there could be a significant impact on patient care.

The fifth model type for data integration is the Central Warehouse model. This model is most similar to the Partitioned Warehouse model. In the Central Warehouse model, a master patient list as well as healthcare information is housed in the same database. Unlike the Partitioned Warehouse, the Central Warehouse does not utilize vaults rather all the information is stored in one database. Healthcare providers are required to update the information in the RHIO on a regular basis.

The main advantage of the Central Warehouse model is the faster query response time because the data is housed in one location, not different vaults. Furthermore, healthcare providers that participate in the Central Warehouse models have the ability to obtain and analyze global patient types and health data for an entire community.

A disadvantage to the Central Warehouse model is the cost and constant update requirements needed to maintain the RHIO. As in the Partition Warehouse model, the sole reliance on one system to house and obtain all patient data could prove to be a disadvantage.

In addition to the data integration models discussed above, application integration is also needed to make a RHIO effective. Application integration is “presenting a unified view of data to a user through a computer application” (Artz, 2005). Application integration is needed to make a RHIO useful to end users by forming data in a readable, useful, and understandable format.
There are several models of application integration that a healthcare organization can utilize, each having advantages and disadvantages. The first RHIO model that a healthcare provider may select for application integration is Data Access via Smart Card. As discussed above, patient data would be stored on a smart card and providers would need a smart card reader/writer to access each patient’s healthcare information. Each patient would own the smart card and the patient would need to present it to each healthcare provider. In this model, the healthcare provider would need to have access to both read the health information already present on the card and update or add information to the smart card as well.

The major benefit of the smart card model is that the patient would own and therefore control access to their healthcare record. The downside to this model is how the healthcare record be updated if the patient does not present the smart card. Much like current insurance cards, patients would not always have their smart cards and may not have them when they are needed most. Additionally, a downside could potentially be related to privacy issues related to the use of the smart card. If the smart card was lost or stolen, non-authorized individuals may able to access all of that patient’s healthcare information.

A second model that healthcare providers may choose for application integration is User access through a RHIO-provided application. As mentioned above, it is common for a healthcare provider to hire an outside company to implement a RHIO. In this model, additional application software would be provided by an outside company and added to a hospital system. Users would use the new software to access healthcare information.
This model has advantages and disadvantages as well. The biggest advantage to this model is the ease of use because the application functions independently of other hospital systems. The disadvantages would be the implementation of an additional program within the healthcare system, which requires additional training and resources and Information Technology support. Multiple systems may lead to end user confusion which may cause reduced functionality for the software application.

A third model is Data exchange with user access through a local application. Using this model, a user access a local application that would send inquires to the RHIO. After the RHIO receives the inquiry from the user’s local system, the RHIO would send a reply back to the user’s local system.

The most advantageous aspect of this model is the continued use of a familiar system. The use of the same local system would eliminate confusion for the end user in determining which system to use for each type of inquiry. The disadvantage to this model is that both the local system and the RHIO would have to agree on what type of language to use to process each inquiry. Although the standard for such language is the Health Level Seven (HL7) interface, the development of the interfaces is somewhat limited based on the healthcare provider. Developing these interfaces can be expensive to smaller healthcare providers. In addition, when a RHIO is unavailable to process inquiries, the response times of local systems may be inadequate and inquiries may be lost. The local systems would have to find a way to store outstanding query items and resubmit the query when the RHIO becomes available.

The fourth model type is Direct User Access through a Local Application. In this model, the health care provider would use a local system to view patients’ healthcare
records. If a healthcare provider needed information, the local system would access the RHIO by using the login information previously supplied by the end user. Once the local system logs into the RHIO, the user would view the information. This model is considered a hybrid of the Data exchange with user access through a local application and User access through a RHIO-provided application. Although the user would view the information using the RHIO application, the selection of the system would be eliminated through the use of the local system in conjunction with the RHIO application.

The advantage to this model is that the user would continue to use a local system for the majority of the time and would not have to manually access a separate RHIO application. Only when additional data is needed would a user have to access the RHIO. The disadvantage would be if the local system could not access the RHIO or if the networks did not communicate with each other.

In addition to selecting data and application integration models, healthcare providers, patients, and policy makers must address many questions including:

- How will the security of the RHIO be maintained?
- How will RHIOs comply with the Health Insurance Portability and Accountability Act of 1996?
- How will individual patients be identified within the RHIO if social security numbers cannot be used?
- Who will have the ability to access information housed in a RHIO?
- What information is available within a RHIO?
- How much information will be accessible to non-healthcare providers?
- Who owns the patient’s medical record?
- Who is going to pay for the implementation of the RHIO?
- Can a patient choose not to participate in a RHIO?

In summary, while the RHIOs may be the answer to communication shortfalls, there are many questions that still need to be answered. As the electronic transfer of clinical information is perfected, RHIOs will expand their functionality to include non-clinical
health data. RHIOs will become less expensive as the technology progresses, but an innovative healthcare provider will be required in each community to spearhead the RHIO movement.
Bibliography


